

"PRESENT AND FUTURE METHODS FOR EFFICIENT IRRIGATION"

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Introduction

Two separate talks have been prepared in an attempt to treat this subject. Neither seem to fit the tone of the conference, furthermore, it may even be ambiguous to treat present and future methods for efficient irrigation. What is efficient irrigation practice under one set of conditions may not be efficient practice under another set. For example in Japan where hand labor is cheap, land scarce, farms small, machinery expensive, and produce valuable; a system of terracing and small basin irrigation has proven to be an economical method of irrigation, whereas such a system of irrigation in most areas in New Mexico would be very inefficient. Considerable variation exists within New Mexico and hence to say any particular system is efficient or inefficient is dangerous without first detailing all the conditions under which it is to operate.

If my consulting experience in South America, Africa, Europe, United States, and Hawaii have taught me anything, it is that conditions change and hence the solutions change. Therefore, for a general nontechnical conference such as this one has been - a conference dealing with concepts and policies - it seems inappropriate to deal with technical aspects of efficient irrigation.

Important ways to avoid waste of water have been outlined by prior speakers. Other speakers during the day will stress the value of sprinkler irrigation, lined ditches, underground pipe, good land management, and they will also present the need for better estimates of water requirement and efficient application. Efficient economical irrigation includes all of these elements, extending from the watershed through the storage facilities and conveyance channels to the farm and involving the eventual application and utilization of water on the farm. All these elements are part of efficient irrigation. Therefore all of these items have a place in a discussion and evaluation of present and future methods for efficient irrigation. Techniques are available for improvement, and improvement can be made. Sprinkler irrigation, for instance, is here to stay. However, it and other methods of water control and application can be justified and indeed will be used extensively only when the economic conditions of an area in question justify their use.

The speed with which new concepts and new ideas are utilized depends upon the attitude of irrigation leaders, technical specialists, administrators, and farmers towards irrigation and toward progress in general. A

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progressive attitude will do much to promote progress; likewise a negative attitude built around the tendency to reject or ignore progress will be very detrimental. Because of the importance of a progressive attitude and vision of the future, this paper will deal primarily with the challenge we face rather than with technical details of irrigation water application.

The Challenge We Face

Today we are living in a marvelous age - an age of change and an age of miracles. Yesterday it was the atomic bomb, today it is satellites and tomorrow it will be inter-planetary travel. What does this age and these events have to do with this specific conference and the problems being considered here?

The influence of these and concurrent developments will have a very profound effect upon irrigation and our water resources. This influence will come about as a result of the new energy sources which are being made available to man. Progress and energy are inseparably connected. The greater the availability of energy, the greater the ability to readily transport energy and the lower the cost of energy, the greater the rate of human progress. Modern progress and technical developments will bring into the realm of feasibility projects and schemes which are now infeasible. We need to reconsider our practices and policies in the light of future energy costs and availability. It may be impossible for us to realize and to visualize the detail of pending developments, but we can be certain of the trend and general influence of those developments. For instance we know without question that energy will in the near future become cheaper and more readily available.

A Challenge to Dream

In this age of progress, our greatest handicap is our lack of imagination and our failure to dream. However, our dreams must be based upon sound engineering principles. An earlier speaker has referred to the combination of imagination and engineering as imagineering. This is a very descriptive word and one which fits the need. We need to imagine and yet we need to engineer. Combining the two together is the desirable thing and referring to that combination as imagineering has considerable merit.

But as we imagineer we should not be restricted by present economic balances. Certainly the economic factors which influence the feasibility of a project today will not maintain the same relative balance in the ten or fifteen years ahead. Twenty five years ago which engineer, technician, lawyer, or farmer would have dared to predict our present world technology and the projects which are today sound and feasible?

To properly develop and utilize our water resources by what we have chosen to term efficient irrigation must demand creative thinking based upon probably

future conditions. This planning and development must not be unduly hampered by our present conditions or our present prejudices. Is it going to be necessary for more of this generation to die before our children are uninhibited and free to make the desired progress in the world which faces them? Or are we big enough to adjust our thinking and our practices to fit these changing conditions?

This condition came forcefully to my mind the other morning just before I left to come to these conferences. My seven year old son brought to me a small airplane which he had made. He has been intensely interested in airplanes, rockets, and space travel. He spends most of his allowance on airplane equipment. The other day he wanted to build an airplane but did not have the money to buy a commercial model. However, he did have sufficient money to buy a small container of glue, and with that container of glue, a few small sticks, and some cardboard, he pieced together a new design. It was this creation of his which he brought to me with a gleam of satisfaction in his eye. He was very pleased when he could show me that as the plane was dropped it glided carefully to the ground without any trace of aerodynamic instability. As I looked at the plane and his accomplishment I could only marvel at what had been done. At the same time I was grateful that I had not unduly restricted his creative development. Even though one of my fields of technical interest is fluid mechanics and aerodynamics at Utah State University, I was grateful that I had not inhibited my son by passing to him certain preconceived notions which were mine as a result of my formal training. I saw originality and understanding within his creation that made me marvel. I am certain that in the future the academic knowledge of aerodynamics which I have accumulated will be of help to him in working out some of the details that are in his mind. But I'm also certain that too early an assimilation of those academic details can only inhibit his creativeness.

Cases Demanding Imagineering

Underground Water Development

In the field of underground water development much of our practice and administration today is based upon the experiences of the past and conditions as they now exist. Restrictions on the rate of development of these underground sources of water are based principally upon the present rates of recharge and depletion and upon existing economic pumping lifts. It is generally believed that we need to preserve these underground resources for our posterity. Whereas we are not trying at the present time using our mineral and oil reserves in such a manner that we will have a perennial supply.

When we talk of depletion I am reminded of the concern during the war for the depletion of our oil reserves, and I am also reminded of the tremendous amount of effort and energy which went into discussions and analysis of the length of time before we would be without oil reserves. However, despite all the pessimistic gloom that existed during the war, today we have greater known oil reserves than at any time in our history. How short sighted would we have been had we refused to utilize the known reserves and had kept them in the ground for our posterity. Our resources of precious minerals, of coal, of oil, and other commodities are mined and utilized for the benefit of mankind. Will our children sometime in the future chide us for being so short sighted with our water resources that we literally hide them in the ground to keep them for posterity?

In the first place I doubt that we know how much underground water exists. Have we actually inventoried our underground water or have we principally speculated on the reserves which exist? It is my firm conviction that we have only started to locate and to evaluate our underground water resources. We need to do more than speculate. We need to actively determine the resources which exist. Private individuals, foundations, state and federal governments, could undertake to advantage a more intensive program of locating and evaluating underground sources of water. Surely this will take money, but it also took money to locate our mineral and oil reserves.

Water Shed Yields

Our estimates of water reserves and resources are based primarily upon conditions over a relatively short period of observation. But what can be done to modify the conditions themselves? To what extent can the yield of the watershed be approved? Only a small percentage of the rainfall on a watershed leaves as surface or subsurface flow. A small change in yield would make a tremendous increase in total available water. Lengthy conservation studies are valuable to test the hypothesis and to justify our claims of getting greater yield from changes in vegetative matter. However, such studies take considerable time to complete. Do we have the necessary time? Should we sit back and wait until that information is available? How about appraising our present knowledge and acting upon the available facts. I firmly believe that we have sufficient knowledge of watersheds, watershed management, and the consumptive use of water by various types of vegetation to predict with reasonable accuracy the improvement which could be expected in watershed yield. We also have sufficient knowledge to make such changes without causing erosion.

We need to appraise our knowledge and to have the courage to back up our convictions. Enough is known to make significant progress. We may not know whether the increase will be 20 or 25% but actually we don't care. Either figure is good enough to justify action. We can predict the first significant figure. We are not too concerned at present about the second.

Climatic Control and Salt Water Reclamation

We should not rule out the possibility of climatic control and salt water reclamation in the near future. If either of these processes has even a reasonable degree of success, our entire economic water balance will be altered. These things are not unrealistic. In fact, today, both climatic control and salt water reclamation are possible but not economically feasible because of the excessive cost of energy in relation to the benefits realized. How will this condition change when energy costs become one tenth of what they are today?

Consequently in considering these questions of water resource development and administration we should take into consideration the changes which will occur in the near future. The foremost consideration should be whether it is physically possible. Economic justification should be based upon future conditions and not upon present economies.

First Great Commandment

The Lord gave a great commandment to Adam and Eve while they were in the Garden of Eden. The instruction while there to multiply and replenish the earth was only part of this first great commandment. The other vitally significant portion of direct concern to this conference was the commandment to subdue the earth. This means climate and ocean, as well as disease, etc. Just as surely as the commandment was given it will be fulfilled. And when it is fulfilled the climate and the ocean will be used to benefit rather than plague man. Why not let our imagination overcome our prejudices and inertia and take active steps to plan for these times?

You may say that these are not realistic suggestions. Likewise neither were the atom bombs or satellites or trips to the moon fifteen years ago. Who among you can dream of the progress to be made in the next fifteen years? Man's lack of sound imagination and faith in the future is his greatest handicap.

Let's take the advice of Mr. D. D. Monroe given at the banquet last evening wherein he stated that we are spending too much time worrying about our problems. Let's talk about our possibilities and opportunities for progress. It would be wise to remember the parable of the talents wherein the man who had talents and developed them was given additional talents. Whereas, he who had limited talents and hid them up in the earth to save them for the future lost that which he had. Likewise we should develop the resources that are in our hands and not hide them up or leave them hid up in the earth. Neither should we waste our time worrying about the talents or resources we do not have.

Specifically, we should spend our intellectual energies developing our known water resources and not wasting excessive time bemoaning the fact that we have water shortages. Much remains to be done. We have a challenge and we have an opportunity; we have the resources to accept the challenge and to meet the opportunity, and thereby build for ourselves a civilization which will stand as a monument to our efforts for which our posterity will be eternally grateful.